

REMARKS

The foregoing amendment amends independent claims 1, 9, 20, 42, 64, 66 and 70. Pending in the application are claims 1-14, 16-45, 47-64 and 66-70, of which claims 1, 9, 20, 22, 29, 42, 64, 66, 67 and 70 are independent. Claims 2-8, 22-41, 49-54, 59, 60 and 67-69 are withdrawn from consideration. The following comments address all stated grounds for rejection and place the presently pending claims, as identified above, in condition for allowance.

Independent claims 1, 9, 20, 42, 64, 66 and 70 are amended to recite that *the sidewall of the microchannel has a uniform thickness along an entire length of the microchannel*. Support for this amendment can be found in Figures 2B-4B and 5B-9H.

Independent claims 1, 9, 20, 42, 64, 66 and 70 are also amended to specify that the meniscus is formed at the fluid interface port *in place of a removed portion of the sidewall*. Support for this amendment can be found at page 18, lines 14-16 of the Present Application.

Independent claims 1, 9, 20, 42, 64, 66 and 70 are further amended to recite *forming a hydrophobic portion in the fluid interface port to repel the first liquid*. Support for this amendment can be found at page 25, lines 19-22 of the Present Application.

Independent claim 20 is also amended to recite that the second filling aperture is formed in the *same* sidewall as the first filling aperture. Support for this amendment can be found in Figure 6, 9G and 9H-10B. *No new matter is added*.

Amendment and/or cancellation of the claims is not to be construed as an acquiescence to any of the objections/rejections set forth in the instant Office Action, and was done solely to expedite prosecution of the application. Applicants reserve the right to pursue the claims as originally filed, or similar claims, in this or one or more subsequent patent applications.

35 U.S.C. §112 Rejections

In the Office Action, the Examiner rejects claims 1, 9-14, 16-21, 42-45, 47, 48, 55-58, 61-64, 66, and 70 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. Applicants submit that the subject matter of the claims is sufficiently

described in the specification as originally filed, and request that the rejection under 35 U.S.C. §112, first paragraph be reconsidered and withdrawn.

Regarding the assertion that the specification does not teach “none of the liquid entering the fluid interface port”, Applicants respectfully submit that adequate support is found in the specification. The Specification provides support for at least two reasons why *none of the liquid enters the fluid interface port*.

The Specification recites that the overall liquid flow through the microchannel of the microfluidic system is not influenced by the virtual wall, i.e. the flow of liquid in the microfluidic system having a virtual wall is substantially identical to the flow of liquid through an identical microfluidic system in which no virtual wall is present. *See Present Application*, page 18, lines 16-20. The virtual wall is formed after forming a fluid interface port in the sidewall of a microchannel. Since the flow of the liquid in the microfluidic system is not changed by introducing the fluid interface port to the microchannel, the liquid will flow *within* the channel, as opposed to flowing *into* the fluid interface port.

In Addition, Applicants amend the independent claims to further specify that *a hydrophobic portion is formed in the fluid interface port to repel the fluid in the microchannel*. The Specification, as originally filed, recites that the liquid repellent portion of the fluid interface port prevents liquid from leaking out of the microfluidic system and ensures the repeatable formation of a virtual wall in the fluid interface port when the microchannel is filled with liquid. *See Present Application*, page 25, lines 23-26. As such, the liquid flowing in the microchannel is repelled from the fluid interface port when a hydrophobic portion is formed in the fluid interface port. The hydrophobic portion prevents the liquid in the microchannel from entering the fluid interface port.

For at least these reasons, Applicants request reconsideration and withdrawal of the 35 U.S.C. §112 Rejection.

35 U.S.C. §103 Rejections

In the Office Action, the Examiner rejects claims 1, 9-14, 16-21, 42-45, 47, 48, 55-58, 61-64, 66 and 70 under 35 U.S.C. §103. Applicants traverse the rejection and submit that the pending claims distinguish patentably over the cited references.

Obviousness Rejections over Heller, McCormick, Amigo, Howitz, Columbus (4,302,313), Bjornson et al., Columbus (4,426,456), Kopf-Sill, Swierkowski, Sundberg and/or Swedberg

Applicants maintain that any combination of the Heller reference, the McCormick reference, the Amigo reference, the Howitz reference, the Columbus '313 reference, the Columbus '456 reference, the Bjornson reference, the Kopf-Sill reference, the Swierkowski reference, the Swedberg reference and/or the Sundberg reference fail to render the claims obvious. As previously set forth, Applicants assert that the claims distinguish patentably over the cited references, either alone or in any combination. In addition, the claim amendments further distinguish the claims over the cited references, either alone or in any combination. The cited references, alone or in any combination, fail to disclose the subject matter of the claimed invention.

i. hydrophobic portion

Independent claims 1, 9, 20, 42, 64, 66 and 70 specify that a hydrophobic portion is formed in the fluid interface port to repel the fluid in the microchannel. The hydrophobic portion formed in the fluid interface port prevents the liquid flowing in the microchannel from leaking out of the microfluidic system. As such, none of the liquid flowing in the microchannel enters the fluid interface port.

The cited references are silent about providing a hydrophobic portion in the fluid interface port. Furthermore, the cited references show fluid entering into the ports. In his Response to Applicants' Arguments, the Examiner asserts that this behavior is a conventional behavior of fluid within a microfluidic device design. The Examiner appears to be looking for a structural difference between the systems of the present application and those of prior art references that will cause this behavior. *See* Office Action, page 22, § 21. Amended independent claims recite forming a hydrophobic portion in the fluid interface port to repel the

liquid in the microchannel. Applicants respectfully contend that this amendment provides a patentable distinction between the system of the present application and that of the cited references.

Moreover, even though the Examiner asserts that forming a meniscus at the fluid interface port is a conventional behavior of fluid within a microfluidic device design, none of the cited references teach or suggest a meniscus formed port *in place of a removed portion of the sidewall* such that the meniscus is *co-planar with the sidewall*. In contrast, the cited references teach that meniscus is formed *within* the fluid interface ports as opposed to meniscus being formed co-planar with the sidewall, in place of a removed portion of the side wall. Specifically Figure 1 of Howitz, Figure 3 of Sundberg, Figures 2-3 of Columbus'451, Figures 1-2 of Swierkowski all illustrate that meniscus is formed within the fluid interface port.

ii. depth and diameter of the port

In addition, Applicants maintain that the cited references, alone or in any combination, do not teach or suggest a device having a fluid interface port with *a depth equal to the thickness of the sidewall and a diameter that is significantly larger than the depth*, as recited in independent claims 1, 9, 20, 42, 64, 66 and 70.

The Examiner correctly identifies that Heller does not explicitly describe the ports as having a diameter significantly larger than their depth. The Examiner cites Amigo and McCormick for the teaching of this claim element. Applicants respectfully submit that the combination of the references fails to teach or suggest a port having a diameter significantly larger than its depth. The Examiner indicates that the depth of the port must be inherently equal to the thickness of the sidewall. Heller is silent about the thickness of the side wall. Amigo and McCormick are cited for providing a cover for the channels having a thickness of 10 microns. However, the combination merely results in providing a cover on the microchannel structure illustrated in Heller. The combination of Heller, Amigo and/or McCormick is still silent about the thickness of the sidewall where the fluid interface port is formed. The combination of Heller, Amigo and/or McCormick merely teaches a channel that has an opening on a side wall, as illustrated in Fig.2 of Heller, covered by a cover of 10 microns thick. The references are

silent as to the thickness of the wall where the fluid interfaces are formed. The references are also silent about the diameter of the ports.

Applicants respectfully submit that Fig. 2 of Heller illustrates an uncovered channel structure. The application areas A illustrated in the Figure are not holes or ports formed on a surface. They are merely enlarged zones of the channel I where samples can be applied. As such, covering the microchannel structure of Heller with the cover of Amigo and/or McCormick, does not result in a fluid interface port *depth equal to the thickness of the sidewall and a diameter that is significantly larger than the depth*, as recited in independent claims 1, 9, 20, 42, 64, 66 and 70.

Even if it is assumed that ports will be formed on the cover, there is no indication of diameter size in any of these references.

Regarding the Howitz reference, Applicants respectfully submit that the ports formed on the side wall illustrated in Howitz' figure do not have a depth that is equal to the thickness of the side wall of the channel. In Howitz, if the side wall is considered the element indicated by reference numeral (3), the ports are not formed on the side wall. If the side wall is considered to be a combination of stacked units (1) and (3) or (1), (3) and (2), the ports do not have a depth that is equal to the thickness of the side wall of the channel. Applicants amend the independent claims to further clarify that the thickness of the side wall is uniform along the entire length of the microchannel. Howitz teaches away from this feature by teaching a device (1) and a spacer (2) stacked on the flow channel.

As described above, all pending claims distinguish patentably over the cited references taken either alone or in any combination. For at least these reasons, Applicants request that the rejections under 35 U.S.C. §103 be reconsidered and withdrawn. For at least the foregoing reasons, claims 1-14 and 16-45, 46-64 and 66-70 are patentable over the cited references and in condition for allowance.

CONCLUSION

In view of the above amendment, Applicants believe the pending application is in condition for allowance. If a telephone conversation with Applicants' attorney would help expedite the prosecution of the above-identified application, the Examiner is urged to call the undersigned attorney at (617) 227-7400.

If any additional fee is due with this statement, please charge our Deposit Account No. 12-0080, under Order No. TGZ-001BRCE3, from which the undersigned is authorized to draw.

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Respectfully submitted,

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